FRG Meeting III: abstracts

Saturday April 25

Kerr (10-11): Fourier coefficients for automorphic cohomology

In recent work with M. Green, P. Griffiths, G. Pearlstein, and C. Robles, we have defined boundary components $B(\sigma)$ for Mumford-Tate domains D, which yield partial compactifications of $\Gamma\backslash D$ in the sense of Kato-Usui, and studied a number of special cases. The Fourier coefficients we shall define (focusing on the nonclassical case) are maps from automorphic cohomology of D to that of $B(\sigma)$, which recover and generalize constructions in the recent literature.

Goldring (11:30-12:30): The irregular case of the Langlands correspondence, I: The automorphic cohomology approach

The Langlands correspondence for number fields, coupled with other groundbreaking conjectures such as that of Fontaine-Mazur, gives rise to a fundamental triangle whose vertices are (1) algebraic automorphic representations, (2) geometric Galois representations and (3) pure motives. One theme of these lectures will be to stress a dichotomy which prevails throughout the triangle: the regular/irregular dichotomy. While a considerable amount is known about the triangle in the regular case, most of the irregular case remains mysterious. At the same time, we shall explain why, from the point of view of algebraic geometry, the irregular case is the most interesting.

We shall focus on the arrow (1)–>(2). There are two approaches to this arrow, which can be termed "automorphic cohomology" and "functoriality". So far these two approaches seem to be quite orthogonal to one another. We will describe recent results and work in progress stemming from each of the two approaches. The results concerning automorphic cohomology are joint work with J.-S. Koskivirta, building on earlier joint work with M.-H. Nicole.

Sunday April 26

Griffiths (10-11): Hodge theory and H-surfaces

An H-surface is a minimal, smooth[1] surface X with $K_X^2 = 2$, $p_g(X) = 2$, and $q(X) = 0$. An interesting question in algebraic geometry is: What *singular* surfaces appear in the Kollár–Shepherd-Barron–Alexeev boundary of the moduli space $\mathcal{M}_H$ of surfaces of general type H? Essentially no non-classical examples are known.

Since the theory of degenerations of polarized Hodge structures is fairly well developed, it is hoped that this theory might serve as a guide as what to expect for the singular surfaces and where to look for them. This talk will describe some of the very beautiful geometry of H-surfaces and some partial answers to the above questions. One point is that for these surfaces there is a Hodge-theoretic object that *(i)* determines the polarized Hodge structure on $H^2(X,\mathbb{Z})_{\text{prim}}$, and *(ii)* for which the constructive global Torelli theorem holds.

Yun (11:30-12:30): Constructing motives by the rigid Langlands correspondence, I

In these three talks, I will give a survey on the construction of motives over number fields with exceptional motivic Galois groups using some special cases of the Langlands correspondence for

[1] or with rational double points

function fields.

Monday April 27

Goldring (9:30-10:30): The irregular case of the Langlands correspondence, II: The functoriality approach

(See above for abstract.)

Laza (11-12): Degenerations of surfaces - geometry and Hodge theory

My talk will be part survey, part report on ongoing research (joint with P. Griffiths and C. Robles) on the problem of compactifying the moduli of surfaces of general type.

Tuesday April 28

Yun (9:30-10:30): Constructing motives by the rigid Langlands correspondence, II

(See above for abstract.)

Brosnan (11-12): On Kato's paper "On $SL(2)$ orbit theorems"

Kato's paper deals with two categories (essentially defined by Deligne) which are related to infinitesimal mixed Hodge modules: the category D_r of r-variable Deligne systems and the category DH of r-variable Deligne-Hodge systems. If we let IMHM denote the category of infinitesimal mixed Hodge modules, then it is easy to see that there are functors IMHM $\to$ DH $\to D_r$. These functors are useful because the category D_r seems simpler to understand than IMHM. The main theorem of Kato's paper asserts that (after some reparametrization) any object in DH comes from a infinitesimal mixed Hodge module. I will explain why this theorem is wrong (by giving a counterexample). Then I will explain how to fix it.

Wednesday April 29

Goldring (9:30-10:30): The irregular case of the Langlands correspondence, III

(See above for abstract.)

Yun (11-12): Constructing motives by the rigid Langlands correspondence, III

(See above for abstract.)